

ASSESSING CRITICAL THINKING SKILLS OF ATHLETIC TRAINING PROFESSIONAL
AND POST-PROFESSIONAL STUDENTS

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MASTER OF SCIENCE

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ABSTRACT

Critical thinking (CT) can be described as using resources, identifying assumptions, asking questions, comparing alternatives, and finally coming to a conclusion. Critical thinking can be used in daily life, general work, or in specialty situations and is a valuable skill in health professions. Athletic training integrates CT into evaluations, treatments, rehabilitation programs, and other activities. Critical thinking is needed in the profession of athletic training to increase accuracy of diagnosis and evaluation and to improve patient outcomes. The purpose of this study was to establish CT baseline scores for athletic training professional and post-professional students. Results revealed that the post-professional students in this sample scored higher on the Health Science Reasoning Test than professional students.

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DEDICATION

This thesis is dedicated to my Essentia Health family, and all of those who have helped me through my life as a young professional. Sean, without your guidance, and advice, I know I would not be where I am today. Thank you for extending your helping hand to me and to others. To my Essentia Health family- Kate, Sheila, Allison, and Tony- some of you I have known since the start of college, and others I met along this journey. Either way, collaborating, visiting, and attending a few business meetings together has helped me immensely. I hope your internal fire and passion for athletic training never ceases to exist. Hopefully Tom reunites with our family again someday. To the countless others that have helped me along the way, you show up in all aspects of my life. You are my parents, my brothers, my fraternal family, my NDSU sisters, and my professors. I have never had to look far for help, and for the endless supply of support, I thank you. May all of you extol virtue, exact harmony, and perpetuate the ideals you have shown me in all aspects of life. I do not know where life will take me but I know all of you will be there to support me and for that I thank you.

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CHAPTER 1. INTRODUCTION

Critical thinking is required in the profession of athletic training to ensure accuracy of diagnosis and evaluation, as well as to improve patient care and outcomes.¹ Athletic training is a nationally recognized health profession that is based on sports medicine.² Athletic trainers are at a variety of events and competitions for pre-game treatments, they are available during the event for injury assessment, and they are able to provide treatment afterwards. In many instances, athletic trainers will be the first health professional a patient will see for their health needs. Athletic trainers work with multiple health care professionals to provide comprehensive quality care for all they treat. Athletic trainers work in multiple settings such as the military, performing arts, professional sports, high schools, clinics, and universities.³

Without critically weighing information, one cannot come to a proper diagnosis and plan. Critical thinking (CT) can be used in many situations. Taking a problem or question, and forming a detailed answer from the information given or found is a piece of CT. When faced with a situation where an end result or issue is not clear, CT will assist in processing, and to help form a knowledgeable plan. The process of CT can be described as using resources, identifying required assumptions, asking questions, comparing alternatives, and finally reaching a conclusion. Critical thinking can be used in daily life, general work, or in specialty situations and it is a valuable skill in health professions. In all of the aforementioned situations, the skill of critical thinking is developed with education and experience. Radtke⁴ believes that clinical education is what separates undergraduate education from technical skills. By identifying goals in clinical education, Radtke shows how the process of clinical education can develop more technically skilled ATs.⁴ In agreement with Radtke, Fuller believes that with the appropriate

education guided by Bloom's *Taxonomy of Education Objectives*⁵ CT can be developed in all AT students, not just the smartest and most skilled.⁶

Although there is limited research regarding CT in athletic training, other health care professions such as nursing programs,⁷ medical school,⁸ pharmacy programs,⁹ and physical therapy school¹⁰ have investigated CT. Currently there is not a global definition for CT. Therefore, this study used the definition provided from the Health Science Reasoning Test (HSRT) by Insight Assessment. Critical thinking was defined as "reasoned and reflective judgment applied to solving problems or making decisions about what to believe or what to do."¹¹ CT gives reasoned consideration to defining and analyzing problems; identifying and evaluating options; inferring likely outcomes and probable consequences; and explaining the reasons, evidence, methods and standards used in making those analyses, inferences, and evaluations.¹¹

Assessing CT is just as important as its definition. Critical thinking can be assessed using a variety of instruments.¹² In theory, as an individual's CT ability improves, so will their score from the assessment. Assessing over a period of time gives researchers the ability to observe a change in CT.

Research Purpose

The purpose of this study was to establish CT baseline scores and to determine whether there was a difference between the CT scores of professional and post-professional athletic training students.

Research Objective

To establish CT baseline scores for professional and post-professional athletic training education.

Research Question

Did critical thinking scores differ between professional and post-professional athletic training students?

Limitations

1. Participants may not have given their best effort on the HSRT.
2. Professional and post-professional athletic training programs vary in program length.

Importance of Study

The importance of this study was to establish a baseline set of data for athletic training education. The baseline data will provide a foundation for future testing. Data was obtained from professional and post-professional athletic training students to form a baseline. A comparison was made between professional and post-professional scores using a T-test. With future testing, further data can be compiled to form a longitudinal CT assessment.

Definition of Terms

Critical Thinking (CT) - Critical thinking is reasoned and reflective judgment applied to solving problems or making decisions about what to believe or what to do. Critical thinking gives reasoned consideration to defining and analyzing problems, identifying and evaluating options, inferring likely outcomes and probable consequences, and explaining the reasons, evidence, methods and standards used in making those analyses, inferences and evaluations.¹³

Professional Program: An entry-level athletic training education degree program. The program can be at the undergraduate or graduate level and must be accredited by CAATE.¹⁴

Post-Professional Program: A graduate degree that promotes the advancement of athletic training skills and knowledge. CAATE accreditation is an option for this program.¹⁵

Athletic Trainer (AT): A unique health care provider who specializes in the prevention, assessment, treatment and rehabilitation of injuries and illnesses.²

Athletic Training: A nationally recognized health profession based on sports medicine that encompasses prevention, first aid, rehabilitation, and educating athletes, coaches, parents, and other sport professionals.²

Commission on Accreditation of Athletic Training Education (CAATE): A professional agency responsible for the accreditation of professional (entry-level) and post-professional athletic training educational programs. The CAATE sets Standards for professional programs and post-professional programs.¹⁶

National Athletic Trainers' Association (NATA): A professional organization for athletic training.²

Board of Certification, Inc. (BOC): The organization that grants athletic training credential for entry-level athletic trainers.¹⁷

CHAPTER 2. LITERATURE REVIEW

The purpose of this study was to establish CT baseline scores and to determine whether there is a difference between CT scores of professional and post-professional athletic training students. The literature review discusses the following topics: the athletic training profession, athletic training educational programs, CT, and assessing CT.

Athletic Training Profession

The mission of the National Athletic Trainers' Association is to enhance the quality of health care provided by an athletic trainer (AT) and to advance the athletic training profession.¹⁸ Athletic trainers work with multiple health professionals to optimize physical activity for patients they treat. Athletic training involves the prevention, diagnosis, and intervention of acute, chronic, and emergency medical conditions. These can be, but are not limited to, physical impairments, functional limitations, or disabilities. Traditionally ATs have worked in colleges and universities, secondary schools, and professional sports.³ Developing and emerging settings for ATs include hospitals or clinics, industrial sites and companies, military branches, performing art centers, physician extenders, and public safety offices.³

An AT must be certified by the Board of Certification, Inc. (BOC).¹⁷ To be eligible to take the BOC exam a student must graduate from an accredited education program and earn a degree in athletic training.¹⁷ Upon passing the BOC exam, one earns the athletic training credential (ATC) and may practice as an AT. Currently, to continue practice as an AT, one must complete fifty continuing education credits every two years.¹⁷

The following five domains describe the content needed in the profession of athletic training: Injury /Illness Prevention and Wellness Protection, Clinical Evaluation and Diagnosis, Immediate Emergency Care, Treatment and Rehabilitation, and Organizational and Professional

Health and Well-Being.¹⁷ Injury /Illness Prevention and Wellness Protection is used to educate participants and manage risk for safe performance and function during activity. The AT is the first professional in charge of educating patients on injury prevention and risk management.¹⁷ An effective form of identifying and informing patients of risks are pre-participation screenings and physicals.¹⁷ These can help to identify genetic conditions such as the sickle cell trait and diabetes or other concerns such as not being in adequate condition for competition. Additional tasks include inspecting gear and facilities for hazards, educating patients on nutrition and recovery, developing emergency action plans (EAP), and maintaining and care for facilities being utilized.¹⁷

Clinical Evaluation and Diagnosis is a task ATs will be required to perform in any job setting.¹⁷ Evaluations can be pre-participation examinations, on-field evaluations and assessments, or a clinical examination. Pre-participation examinations are used to assess the readiness of a patient. On-field evaluations assess acute conditions that happen during physical activity. Clinical examinations are performed in a facility or clinical setting. On-going evaluations are assessments made on a regular basis to identify how a patient is doing and how the injury is healing. This allows the AT to modify treatment and the rehabilitation being utilized to help the patient progress.¹⁷

Athletic trainers are health care professionals who are often present at recreational and sporting events. Immediate Emergency Care is recognizing and determining a medical emergency and implementing the Emergency Action Plan (EAP).¹⁷ Emergency equipment such as splints, spine board, cervical collar, and an AED should be readily available.

Treatment and Rehabilitation includes therapeutic modalities and exercise used in the plan of care for injury management. The plan of care includes short term and long term

rehabilitation goals, use of therapeutic modalities, and protective equipment for injury prevention during activity.¹⁷

An AT has administrative and professional development responsibilities. Organizational and Professional Health and Well-Being include budget and financial resources, maintaining records, and following state and national regulatory guidelines.¹⁷

Athletic Training Educational Programs

Professional Program

A professional program can be offered as an undergraduate degree or a graduate degree and must be accredited by the CAATE.¹⁴ Professional programs have foundational and professional courses including human anatomy and physiology, exercise physiology, biomechanics, risk management, assessment of injury/illness, pathology of injury/illness, assessment of injury/illness, general medical conditions and disabilities, therapeutic exercise, rehabilitative techniques, health care administration, weight management and body composition, psychosocial intervention and referral, medical ethics and legal issues, pharmacology, and professional development and responsibilities.¹⁹ Professional education programs are medical based education models designed to prepare students to become health professionals with an emphasis on clinical reasoning.¹⁹

The Competencies and Clinical Integrated Proficiencies (CIP) referenced in the Commission on Accreditation of Athletic Training Education (CAATE) Standards are set forth by the NATA Executive Council on Education.¹⁵ Each institution integrates the Competencies and CIP's into didactic and clinical coursework. A student should also have a basic knowledge of applied sciences such as chemistry, biology, physics, psychology, and statistics. Along with academic classes, various clinical experiences under the supervision of an AT or other health

professional is required. During clinical experience, each student must practice and master skills and behaviors of professional practice.¹⁷

The CAATE accredits and sets the Standards for professional programs.¹⁵ Standards for a professional program cover multiple aspects of education including sponsorship, outcomes, personnel, program delivery, health and safety, financial resources, facilities and instructional resources, operational policies and fair practices, program description and requirements, students records, and distance learning sites.¹⁴

The BOC Role Delineation Study (RD) is a document aimed to prepare athletic training students with knowledge and skills needed to be a competent entry-level AT. The RD has five domains: injury/illness prevention and wellness protection, clinical evaluation and diagnosis, immediate and emergency care, treatment and rehabilitation, and organizational and professional health well-being.¹⁷ The RD is modified over time to accommodate the changing profession of athletic training. This ensures athletic training education encompasses all topics.

Post-professional Programs

Post-professional programs for athletic training are graduate level and include masters or doctorate degrees. To be eligible to apply for these programs one must have an entry-level athletic training degree and be eligible for the BOC exam or be an AT. Some post-professional programs are accredited by the CAATE but accreditation is not required.¹⁴

Post-professional programs have developed Standards to enhance the competence of entry-level athletic trainers.¹⁵ Standards for a post-professional program cover various educational aspects including sponsorship, outcomes, personnel, program delivery, financial resources, facilities and instructional resources, operational policies and fair practices, program

description and requirements, and student records.¹⁵ Institutions are encouraged to find new ways to approach and exceed the Standards.¹⁵

Post-professional Standards are categorized as either compliance Standards or aspirational Standards.¹⁵ The majority are compliance Standards, denoted by the word “must,” and the remainders are aspirational Standards denoted by “should.”¹⁵ Compliance Standards exist to ensure minimum education levels and ensure the required level of quality is met. Accreditation is based solely on a program’s ability to satisfy each Standard. Aspirational Standards are not required. Aspirational Standards are used to denote a state the CAATE feels must exceed the minimum recommendation. If an aspirational Standard is not satisfied, the program must justify not meeting the criterion. All sections of the Standards contain compliance Standards but only three sections contain the five aspirational Standards.¹⁵ These three are Sponsorship, Personnel, and Program Delivery.

Post-professional programs incorporate competencies for advanced clinical practice but do not have Clinical Integration Proficiencies (CIPs) like professional programs.¹⁵ The six core competencies of a CAATE accredited post-professional program are: Patient-Centered Care, Interprofessional Education and Collaborative Practice, Evidence-Based Practice, Quality Improvement, Healthcare Informatics, and Professionalism.¹⁵

Patient-centered care is making an effort to compassionately inform, educate, and communicate with patients. An AT competent in patient-centered care shows the ability to serve as an advocate for the patient’s best interests. Interprofessional Education and Collaborative Practice is designed to improve an AT’s collaborative practice and interactions with other health professionals. Post-professional students should have multiple opportunities to work with educators, practicing clinicians, and students from health care professions. Implementing

collaborative practice will optimize the quality of care provided to patients. Evidence-Based Practice is a combination of research evidence, clinical expertise, and patient values. Post-professional programs must show an intentional effort to link didactic course work to clinical decision making. Competency in evidence-based practice correlates to an AT's ability to integrate research with clinical expertise. Quality improvement dedicates the AT to self-evaluation and life-long learning. This includes the ability to identify an improvement objective and specify changes expected to produce. Use of Health Informatics relates to an AT's ability to use numerous resources to find recent information for both professional use and to benefit the patient. Professionalism is exhibited through the delivery of patient-centered care, participation as a member of a health care team, and commitment to the advancement of patient care.

Critical Thinking

Post-professional education programs list CT as a Standard and must be included in a program's scholarly experiences.¹⁵ This compliance Standard ensures that students will develop and improve CT while completing their degree. Currently, CT is not a required Standard for professional programs but AT education is continuously changing and someday CT may be listed as a Standard for professional programs.

Critical thinking can be used for many things in AT. An example is using CT are to modify treatments and rehabilitation to make it personalized for the patient, and designing their plan specifically for the patient and situation to enhance rehabilitation protocol versus using a general program. Another is bracing and taping being continuously changed and modified from day to day to better suit the patient and their current condition. Without CT, diagnoses can be misconstrued and mistakes can be made more easily leading to a less effective treatment program and longer recovery time.

Critical Thinking in Health Professions

Critical thinking is essential for health professionals from diagnosing to treating, and transitioning from theory to practice.⁷ The following definitions of CT come from various health professions. John Dewey brought the term *Critical Thinking* to the attention of teachers and educators in *Democracy and Education: An Introduction to the Philosophy of Education* by John Dewey²⁰, which focused on higher education, upper levels of learning, and how each are taught. The THINK model by Rubenfeld and Scheffer²¹, derived from John Dewey's book, breaks higher level thinking into five categories denoted by the acronym.

1. *Total* recall is the ability to remember facts, such as special tests and disease history, and how to locate them.
2. *Habits* or actions are thought processes and abilities that are second nature.
3. *Inquiry* is examining issues in depth and questioning the details to establish validity.
4. *New ideas* and creativity force a person to think as an individual and use his or her own thought process to develop a plan or theory.
5. *Knowing* how you think is the last section of Dewey's model.²²

This model shares many qualities with definitions given from fields of nursing and athletic training.²² Many different professions use the term CT, but one definition does not cover all professions. Scheffer²³ argues that forming a definition is only the beginning of CT research and needs to be pursued further because of its extensive and exhaustive use in the medical world.

Numerous definitions come from the profession of nursing. Authors^{1, 8, 12, 23, 24, 25} in the nursing field have designed definitions for CT for studies and meta-analyses. Brunt¹² states that CT is a skill built on ideas and standards from a person's good judgment. This skill results in accurate assessments, independent thinking, accurate evaluations, and diagnoses.¹² Other authors

share some common pieces of Brunt's views such as Bethune,²⁵ Paans, Sermeus, Neiweg, and Der Schans,¹ and Scheffer.²³ The common elements in their ideas are that critical thinkers need to possess knowledge and skills to become a full critical thinker. Bethune states that CT is more than a set of skills; it is the ability to use theories, evaluate situations, and use higher ability to form and change a person's beliefs.²⁵ Some skills or traits mentioned by each author are being decisive, creative, inquisitive, having perseverance, and always seeking the truth.^{1, 23, 25} Even though some crossover does exist, each definition is different.

The definitions from the studies of Scheffer²³ and Paans, Sermeus, Neiweg, and Der Schans¹ are similar. Both articles separate CT into skills and thought processes, or habits.^{1, 23} Scott, Markert, and Dunn⁸ have defined CT as using evidence, thoughts, and generalizations to form an assessment. Critical thinking is described as a needed skill covering multiple habits of thinking and an ability to be consistent and accurate with needed skills. Critical thinking is a necessary component of nursing. Critical thinking develops accountability, and improves quality of care.²³ Paans, Sermeus, Neiweg, and Der Schans¹ definition coincides with Scheffer's²³ with accountability and quality of care but contrast slightly in that skills are combined with habits. These sources of knowledge can be used to base an intervention for diagnosis and applying reasoning skills.¹

Scheffer conducted a multicultural study gathering information to make a definition from experienced nurses in Japan, Korea, Netherlands, Thailand, England, Canada, Brazil, and 23 states.²³ The purpose of this study was to define CT in nursing but this was not achieved. The result was the ten Habits of the Mind, or cognitive components, and seven skills, or affective components. The ten Habits of the Mind were perseverance, open-mindedness, flexibility, confidence, creativity, inquisitiveness, reflection, intellectual integrity, intuition, and contextual

perspective.²³ The seven skills were information seeking, discriminating, analyzing, transforming knowledge, predicting, applying standards, and logical reasoning.²³

Nursing educators Zygmunt and Schaefer state that CT is the ability to perform analysis, inference, evaluation, and rational thinking.²⁶ Using these skills can show a person's understanding and knowledge. Critical thinking skills will develop through experience and practice. With gained experience, CT skills can be passed on through teaching and mentoring students.²⁶ Lunney refers to his definition of CT as intelligence.²⁷ This is an attempt to make an all-encompassing definition, but intelligence is defined differently in professions outside of nursing and other cultures. The same reasoning is used in IQ tests, which are relevant only to what is being tested. Intelligence can continuously grow and improve through practice, reflection, and evaluation. Shaping, selecting, and adapting to an environment in life will make you more intelligent.²⁷

Finn²⁴ has an extensive definition, stemming from research in medical schools that state CT is the ability and willingness to assess claims, make objective judgments from reasoning, and using evidence rather than opinion or emotion. Critical thinking includes the ability to be creative and constructive along with being able to come up with alternative explanations for events, research implications, and application of knowledge to social and personal problems.²⁴ Three skills that summarize CT in his mind are interpretation, evaluation, and metacognitive skills.²⁴

As defined by Zettergen and Beckett, traditional physical therapist education emphasizes technical skills and not complex cognitive skills.¹⁰ Educators in physical therapy suggest that education programs develop these cognitive skills along with psychomotor and affective behaviors. Critical thinking in the field of physical therapy is operationally defined as the ability

to question logically, to identify, create, and evaluate pieces of logical argument; to notice and differentiate facts, fallacies, assumptions, and to distinguish the relevant from the germane.¹⁰

Walker presents four common definitions of CT in the *Journal of Athletic Training*.²⁸ The first is purposeful thinking in which an individual habitually and systematically imposes criteria and standards into their thought. The second definition is a composition of skills and attitudes to invoke the ability of recognizing problems and supporting the truthfulness of each problem. Definition three is having the skill and propensity to engage oneself in an activity while being appropriately skeptical. The last definition is having self-regulated, purposeful judgment. Walker found a correlation between CT scores and a disposition to think critically. Characteristics include inquisitiveness, open mindedness, systematicity, truth seeking, self-confidence, and maturity.²⁸ Leaver-Dunn, Harrleson, Martin, and Wyatt, athletic training educators and researchers, described the critical thinker as reflective, attentive, takes time to use a process, and is able to better themselves.²² The American Psychology Association, stated by Leaver-Dunn, defined the ideal critical thinker as inquisitive, well in-formed, open minded, thorough in evaluation, neutral to bias, makes good judgments, able to reconsider, clear about limitations, and persists on getting results.²² This study used the definition from the HSRT test. The HSRT defines CT as; reasoned and reflective judgment applied to solving problems or making decisions about what to believe or what to do.¹¹

Professional Experience

Bethune and Jackling conducted a study with nurses that previously had an apprenticeship or a college education as both groups were entering graduate school.²⁵ The study assessed how much each student's CT skills improved through the education. The study proved that nurses with an undergraduate background took to the information faster but did not have a

higher perception of improvement. The nurses who had an apprenticeship background showed improvement of CT scores similar to those with an education background but perceived a bigger change. Prior education gave the students a heightened CT level when the study began, changing the perception of the CT increase.²⁵ Bethune identified that combining experience and education, the mental process has been shown to change.²⁵ Experience has an influence on CT test scores.⁹ When comparing nurses with degrees and nurses with experience but no degree, test scores are higher with those that have previous experience over education alone. The California Critical Thinking Disposition Index (CCTDI) scores support this theory.¹ The nurses that scored higher on the CCTDI were older and more experienced. Multiple clinical experience courses or sites can simulate real life situations to prepare and influence students for working and building CT. Educational courses should focus on further investigation, the ability to ask questions for further guidance, examination of hypotheses to draw their own conclusions, to develop arguments for or against ideas, and reflection to increase memory retention.²⁵

Assessing Critical Thinking

Multiple tests exist to assess CT. Each test has similarities, but some are specialized for a specific major or profession. Results from one test cannot be compared to another due to each test being designed differently.⁹ Tests listed in the article by Brunt¹² are Watson-Glaser Critical Thinking Appraisal (WGCT); Watson & Glaser, the California Critical Thinking Skills Test (CCTST); Falcone, Cornell Critical Thinking Test; Ennis, Millman, & Tomko, and the CCTDI; Facione & Falcone.²⁹ Time to finish a test varies between each one, covering between 40 and 50 minutes. Each test has varied subject material, testing students on inference, analysis, responding appropriately, induction, and open-mindedness.²⁹ Each test has been looked at for

their respective reliability, with the CCTDI being highest at .91, and version 2 Cornell test lowest at .50.¹² Definitions of CT for each of these assessments are found in Table 1.

Table 1. Critical Thinking Assessment Definitions of Critical Thinking

<u>Instrument Title</u>	<u>CT Definition</u>
Watson-Glaser Critical Thinking Appraisal	Critical thinking is the ability to consider a range of information derived from many different sources, to process this information in a creative and logical manner, challenging it, analyzing it, and arriving at considered conclusions which can be defended and justified. ³⁰
California Critical Thinking Skills Test	Critical thinking is purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. ³¹
Cornell Critical Thinking Test	Critical thinking is defined as reasonable and reflective thinking focused on deciding what to believe or do. ³²
California Critical Thinking Disposition Inventory	Critical thinking is purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. ³¹
Health Science Reasoning Test	Critical thinking is reasoned and reflective judgment applied to solving problems or making decisions about what to believe or what to do. ¹¹

The WGCT is an assessment that provides a general assessment of CT. This tool is not discipline specific, offers two forms of testing, and holds a time limit of forty minutes to complete eighty questions. The WGCT has been used in general CT assessments but is one of the few not used in published nursing studies. The test itself is broken down into four areas. They are inference, recognition of assumptions, interpretation, and evaluation of arguments.⁸ Watson-Glaser Critical Thinking Assessment has been compared to student GPA and shows a positive correlation (end of 3rd year med students).⁸ The WGCTA is used to compare logical and creative aspects for CT(See Table 2).

The CCTST is stated to be more appropriate to nursing but neither the WGCT nor the CCTST is made specifically for nursing.^{12, 25} The CCTST is an instrument developed to assess general critical thinking skills of college aged individuals. This test has achieved the highest reliability scores when compared to other common CT tests. The CCTST and WGCTA have similar qualities in a sense that both are general tests and these are not specific to any profession. Previously tests have been used for entry requirements, comparison of groups, compiling baseline data, and change over time.^{9, 25} The CCTST has also been used in the field of pharmacy⁹ and athletic training.³³

The CCTDI measures the extent to which a person shows critical thinking attitudes and is often used with the CCTST. The CCTDI's purpose is to measure the attitudes a person displays towards CT and is a general tool that is commonly is used with another test. This technique is used to form a specific assessment of CT. When the CCTDI is used alone the assessment forms a general idea instead of a specific one. The seven domains of CCTDI are truth seeking, open mindedness, analyticity, systematicity, self-confidence, inquisitiveness, maturity. A general rule

within the CCTDI is that a total score of less than 280 could be used as a cutoff point indicating a deficiency in CT.¹

The Cornell Critical Thinking test has two versions, with version 2 being shorter and having a higher reliability than version 1. The Cornell Critical Thinking Test is mainly used in education research (Table 2).

The HSRT focuses on the relationship between reasoning skills and diagnostic accuracy. The test has five domains that are: analyses, evaluation, inference, deductive reasoning and inductive reasoning.¹¹ Analyses has dual meaning in this test. First is to understand the significance of opinions, experiences, and situations. Second is the ability to understand the connection between statements, questions, and facts. Evaluation also has two meanings with the ability to assess credibility in statements while determining relationships and the ability to reflect on procedures and results. Inference is defined by the ability to dissect assumptions and hypotheses. Deductive reasoning is the ability to process the truth from a premise, such as a diagnosis. Inductive reasoning is the ability to arrive at a rule that is more or less probable based on finite observations.¹ While the CCTST has a large research base compared to the HSRT, the HSRT is designed for testing health science professionals and students in health science programs at the college level. The generic CCTST has everyday situations to consider, where the HSRT uses contexts from a health sciences world. The information tested in the HSRT is not discipline specific, and no knowledge is presumed. The questions are presented in health science contexts, and specific information needed to respond appropriately to the question is given. This enables the HSRT to be used with students and experienced professionals. Participants in the past have engaged the HSRT more readily knowing that the test is focused on their current or future professional setting. For the previous reasons listed, the HSRT was used in this study.

Table 2. Critical Thinking Assessment Descriptions and Reliability

<u>Instrument Title</u>	<u>Instrument Description</u>	<u>Reliability</u>
Watson-Glaser Critical Thinking Appraisal	Provides general assessment of CT, not discipline specific, two forms of testing, 40 minute time limit, 80 questions	.73 ¹²
California Critical Thinking Skills Test	Developed to assess general CT skills of college aged individuals, 34 multiple choice	.68-.69 ¹²
Cornell Critical Thinking Test	Two versions (71 item or 52 item), 50 minute	Version 1- .67-.90, Version 2- .50-.77 ³²
California Critical Thinking Disposition Inventory	Shows CT attitudes, commonly used in conjunction with CCTST, 75 item	.90-.91 ¹²
Health Science Reasoning Test	Designed for health science professionals and students at the college level, 33 questions, 50 min	.68-.80 ¹¹

Summary

Athletic training is a health care profession that involves prevention, evaluation, diagnosis, and treatment of acute, chronic, or emergency medical conditions. In the profession of athletic training, CT is a valuable skill. Critical thinking is listed as a Standard in post-professional education programs and must be included in a program's curriculum but at this time CT is not a requirement for professional programs. Currently, there is a lack of published CT research in the profession of AT.

Critical thinking research has been conducted in various professions and has resulted in multiple definitions of CT and various CT assessment tools. Each test has similarities, but some are specialized for a specific major or profession. The HSRT is a CT assessment designed for those in health sciences education programs and those practicing in the health sciences. Further CT research needs to be conducted in the AT profession. Critical thinking data can then be used to influence continuous progress in AT education Standards for professional and post-professional programs.

CHAPTER 3. METHODS

The purpose of this study was to establish critical thinking (CT) baseline scores and to determine if there was a difference between CT scores of professional and post-professional athletic training students.

Subjects

Initially, 18 programs from nine universities with CAATE accredited professional and post-professional programs were invited to participate in this study. Three professional and five post-professional programs agreed to participate. Three professional programs agreed to participate, however, only one actually participated. For the post-professional programs, of the five that agreed to participate, two actually participated. Six professional and four post-professional subjects completed the Health Science Reasoning Test (HSRT). To increase the number of subjects completing the HSRT, the co-investigator amended the approved Institutional Review Board (IRB) document (Appendix 2). Inclusion criterion was amended to include post-professional programs not accredited by the CAATE. One additional university was invited to participate. No subjects completed the HSRT. The IRB document was amended a second time. The program recruitment procedures were changed. Four additional professional programs and three post-professional programs agreed to participate. Of the four professional programs that agreed to participate, two actually participated. For the post-professional programs, of the three that agreed to participate, two actually participated. One professional and seven post-professional subjects completed the HSRT. A total of 45 programs were invited to participate and a total of seven professional and 11 post-professional subjects completed the HRST. One subject's data was removed due to not completing the assessment in the allotted time. Demographic data collected in this assessment were age, sex, ethnicity, university attending,

years certified, and whether or not the participant had previously taken the Health Science Reasoning Test (HSRT). Answers to the demographic questions were selected by clicking on drop down boxes and selecting the appropriate answer. The demographic question regarding years certified pertained only to post-professional participants. Gender and ethnicity demographics were collected for Insight Assessment's use in their statistics as well as gender being collected for a comparison analysis in this study. University attending was collected for the ability to distribute data to program directors upon request.

Average age of participants from professional programs was 23.00 ± 1.26 years and the average age of post-professional participants was 24.64 ± 1.69 years. Eleven females and seven males participated in the study. Seven professional and 11 post-professional students participated however; one professional participant's result was removed due to not completing the assessment in the allotted time. All participants were currently enrolled in the final year of their respective academic program.

Instrumentation

The HSRT is a CT assessment test for those in health sciences educational programs, undergraduate or graduate, and for health science practitioners. Insight Assessment provides research to support internal consistency (.68 to .80) and validity (.81) for this assessment tool.¹¹ The HSRT consists of 33 multiple choice questions, over an optional but recommended 50 minutes, with a maximum score of 34, and covers these five domains: analyses, evaluation, inference, deductive reasoning and inductive reasoning.¹¹ Demographic data collected included age, gender, ethnicity, university attending, years certified, and whether or not the participant had previously taken the HSRT. Age, sex, and ethnicity are required demographics that Insight

Assessment collects to compile statistics for their normative data. A paper copy of the HSRT could not be included because of Insight Assessment copy rights.

Procedures

Universities with both a CAATE accredited professional and post-professional program were identified from the CAATE website. Mailing addresses were obtained from each university website for the respective program director. Program directors were sent a letter via United States Postal Service explaining the study and informing them of a future email inviting them to participate (Appendix 3). One week later, an email was sent to program directors explaining the procedures of research project and the HSRT (Appendix 5). Additionally, the email requested program directors accept the invitation to participate by replying to the co-investigator. Once program directors responded accepting the invitation to participate, the instructional email was sent (Appendix 5). The instructional email explained which students (professional or post-professional) should receive the email attachments, HRST testing information, how long the testing window would be open, and when reminder emails would be sent. Email attachments contained description of the research project, testing instructions, and user names and passwords for the program. (Appendix 5, 7, 8). The HRST was then activated for a two week period (the testing window) via Insight Assessment. Twenty-four hours after the testing window was opened, an email reminder (Appendix 5) was sent to participating program directors notifying them that the testing window was opened. The email reminder also contained the same attachments and information of the instructional email (Appendix 7, 8). After the testing window was opened for one week, a second and final email reminder was sent to participating program directors. One program director contacted the co-investigator via email stating they had sent the instructional email to their respective students one week late. Therefore, the testing

window was left open an additional week to accommodate the students. The desired amount of participation was not achieved and further data would need to be collected based on analysis requirements.

To increase data, inclusion criterion was modified and IRB approval was granted. Inclusion criterion was modified to include non-accredited CAATE post-professional programs. An additional program was invited to participate. An email was sent to the program director explaining the procedures of research project, and the HSRT (Appendix 5). Additionally the email requested the program director reply to the co-investigator to accept the invitation to participate. Once the program director responded accepting the invitation to participate, the program director was sent the instructional email (Appendix 5). The instructional email explained which students (professional or post-professional) should receive the email attachments, testing information, how long the testing window would be open, and when reminder emails would be sent. Email attachments contained a description of the research project, testing instructions, and user names and passwords for the program (Appendix 7, 8). The HSRT was then activated for a two week period (the testing window) via Insight Assessment. Twenty-four hours after the testing window was opened, an email reminder (Appendix 5) was sent to participating program directors notifying them that the testing window was opened. The email reminder also contained the same attachments and information of the instructional email (Appendix 7, 8). After the testing window was opened for one week, a second and final email reminder was sent to participating program directors (Appendix 5).

A power analysis was calculated to determine the minimal number of completed tests needed for statistical analysis. The power analysis was performed to determine the smallest significant difference of one point on the HSRT. The analysis determined that 15 participants

were needed in each program to achieve power. Inclusion criterion was modified and IRB approval was granted for a second time. Program directors from regional college/universities were contacted via telephone using a script to recruit students (Appendix 6). Once recruitment had finished an instructional email was sent to programs directors (Appendix 5). The instructional email explained which students (professional or post-professional) should receive the email attachments, HSRT testing information, how long the testing window would be open, and when reminder emails would be sent. Email attachments contained a description of the research project, testing instructions, and user name and passwords for the program (Appendix 7, 8). The HSRT was then activated for a two week period (the testing window) via Insight Assessment. Twenty-four hours after the testing window was opened, an email reminder also contained the same attachments and information of the instructional email (Appendix 5, 7, 8). After the testing window was opened for one week, a second and final email reminder was sent to participating program directors (Appendix 5). Once the two week testing window was completed, data received was compiled by Insight Assessment and forwarded to the co-investigator via email. A two tailed T-test was performed on each data set: overall scores, induction, deduction, analysis, inference, and evaluation.

Statistical Analysis

Data retrieved from Insight Assessment was analyzed using a two tailed T-test with a p-value of $<.05$ to compare HSRT results between athletic training professionals and post-professionals (SAS Version 9.4, March 2014). Comparison was made between professional and post-professional athletic training students as well as establishing a baseline of CT scores. The two tailed T-test was used to determine if there was a significant difference between professional and post-professional overall scores and the five domains of CT from the HSRT. The data

collected and analyzed can serve as a reference for future testing of athletic training professional and post-professional students. Descriptive statistics were collected for age, gender, and years certified.

CHAPTER 4. RESULTS

The purpose of this study was to establish critical thinking (CT) baseline scores and to determine whether there was a difference between CT scores of professional and post-professional athletic training students.

Demographic Data

Forty-five programs were invited to participate. Thirteen program directors agreed to participate by sending the information to their students. Out of the thirteen programs that agreed to participate, students from seven programs completed the assessment (two professional and five post-professional programs). Seven professional students and 11 post-professional students completed the HRST. Average age of professional participants was 23.00 ± 1.26 years and the average age of post-professional participants was 24.64 ± 1.69 years. Three females and four males completed the assessment from the professional programs, however; one male's result was removed due to not completing the assessment in the allotted time (Table 3).

Table 3. Professional Student Demographics

<u>Age</u>	<u>Gender</u>	<u>Years Certified</u>
22	F	Not Certified
24	F	Not Certified
24	M	Not Certified
23	F	Not Certified
21	M	Not Certified
24	M	Not Certified

Out of the post-professional participants, eight were female and three were male. Eleven of the post-professional students were certified; two had been certified for 0-1 year, eight had been certified between 2-3 years, and one was certified 4-5 years (Table 4). None of the participants had previously taken the HSRT.

Table 4. Post-Professional Student Demographics

<u>Age</u>	<u>Gender</u>	<u>Years Certified</u>
23	F	0-1
24	M	2-3
24	F	2-3
25	M	2-3
26	F	2-3
25	M	0-1
24	F	2-3
23	F	2-3
24	F	2-3
24	F	2-3
29	F	4-5

Results

Data was collected from professional and post-professional students (Table 5 and 6).

Table 5. Professional Student HSRT Scores

<u>Overall (*34)</u>	<u>Induction (*11)</u>	<u>Deduction (*11)</u>	<u>Analysis (*7)</u>	<u>Inference (*7)</u>	<u>Evaluation (*7)</u>
22	7	7	4	4	4
24	7	9	5	5	4
23	7	9	5	3	4
21	7	5	4	5	4
20	7	7	5	2	5
23	7	9	5	5	4

*Total possible score

Table 6. Post-Professional Student HSRT Scores

<u>Overall (*34)</u>	<u>Induction (*11)</u>	<u>Deduction (*11)</u>	<u>Analysis (*7)</u>	<u>Inference (*7)</u>	<u>Evaluation (*7)</u>
24	9	8	5	3	6
26	8	8	5	5	5
26	9	9	5	4	6
28	9	9	6	4	6
29	10	10	6	5	6
24	7	8	5	3	5
23	6	7	5	3	3
24	8	8	4	5	5
22	7	6	5	4	4
27	9	10	5	6	6
22	9	7	3	5	6

*Total possible score

There was seventeen HSRT assessments completed (six professional, 11 post-professional) with an average overall score of 24 ± 2.47 . Table 7 shows a comparison of means for overall HSRT score, induction, deduction, analysis, inference, and evaluation. Average overall score from professional participants was 22.17 ± 1.47 . Average overall score of post-professional participants was 25 ± 2.37 . A two-tailed T-test of the overall scores resulted in a p-value of .018.. This indicated a significant difference between the overall CT scores of professional and post-professional. Two tailed t-test results show a significant difference between professional and post-professional scores in the areas of overall HSRT score, induction, and evaluation.

Table 7. Overall Means and T-test Result

	<u>Professional Mean</u>	<u>Post-Professional Mean</u>	<u>T-test Result</u>
<u>Overall Score</u>	22.17 (± 1.47)	25 (± 2.37)	.018
<u>Induction</u>	7.00(± 0.00)	8.27(± 1.19)	.021
<u>Deduction</u>	7.67(± 1.63)	8.18(± 1.25)	.476
<u>Analysis</u>	4.67(± 0.52)	4.91(± 0.83)	.529
<u>Inference</u>	4.00(± 1.26)	4.27(± 1.01)	.633
<u>Evaluation</u>	4.17(± 0.408)	5.27(± 1.01)	.023

Summary

Data was collected from 17 completed HSRT's. Post-professional students had a higher average overall HSRT score compared to professional students. A significant difference was found between post-professional and professional scores in the areas of overall score, induction, and evaluation. The data found can be used as a baseline to compare HSRT results with other current data or as a comparison to future data collected from AT students.

CHAPTER 5. DISCUSSION

The purpose of this study was to establish critical thinking (CT) baseline scores and to determine if there was a difference between CT scores of professional and post-professional athletic training students.

Discussion

Post-professional students scored on average three points higher on the HSRT than the professional students. Confounding variables for this project included: testing window length was different for some students due to information being forwarded late, age of each participant is not the same, some participants have been credentialed longer than others, participants from different universities do not have the same professors, and the professional group contained both undergraduate and master level programs. Post-professionals have opportunities for more time to practice their clinical skills, more experience with research, and additional education. Also, post-professionals have passed their BOC exam, enabling them to start their career and have the opportunity to gain experience. These factors could contribute to the resulting difference shown between professional and post-professional participants but identifying a single contributor could not be determined.

Another confounding variable is time and motivation of participants while taking the HSRT. It was discovered during data collection that participants may not share the same amount of interest in a research topic or in research overall as the co-investigators. A participant may not have tried their hardest on the assessment or tried to complete the assessment at a high pace to finish it and move on to a different task. The HSRT User Manual¹¹ states that a test completed in 15 minutes or less could be invalid due to the time it takes to read and comprehend each question and choose an informed answer. One post-professional HRST scored a 23 overall and was

completed in 16 minutes. This is a below average result for post-professional participants but is still higher than the professional participants average score. Average time for post-professional participant's to complete the assessment was approximately 35 minutes compared to professional students who took an average of 38 minutes.

Further education is identified in previous studies^{9, 34} as a contributor to increased CT scores along with clinical experience.³⁵ The results from these past studies^{9, 34, 35} cannot be generalized to this study but provides evidence towards it's plausibility. Post-professional students generally have more clinical experience than the professional student but it may not be directly related to their education, and some students may be focused on research instead of clinical experience.¹⁴ For example, a post-professional student who has an athletic training graduate assistantship or job outside of his/her education program still conducts research and attends classes. Professional students have clinical hours that are meet in order to satisfy their program requirement.

Post-professional students immerse themselves into the process of evidence based practice,¹⁴ therefore increasing their truth seeking, which may be a factor for increased CT scores.²² Although research plays an important role in professional and post-professional education, some post-professional programs have focused research integrated into their curriculum, encouraging students to form research questions along with the associated answer.

Few, if any at all, studies have investigated CT comparisons of professional and post-professional athletic training education but other disciplines have assessed CT longitudinally. Education has been indicated in previous studies^{1, 6, 9, 25, 29} to cause improvements in CT scores over time. A study conducted by Kaddoura³⁶ showed that in nurses, further education and reflection can lead to increased CT scores and an increased perception of CT. Kaddoura's³⁶

study used a simulation teaching technique in combination with reflection. In conjunction with new technology, access to previous research, and active learning to influence CT and confidence growth was noted in newly graduated nurses of an intensive care unit. Study participants noted that reflection and discussion on their experience increased their confidence, but also made the participants more perceptive to the educational progress they were undergoing. In comparison, Kaddoura's³⁶ study used a CT assessment on recently graduated students, while this study compared students at two different levels of education. Miller's⁹ study mapped CT scores over time during pharmacy education for four years. Miller's⁹ study used subjects advancing through a four year doctorate of pharmacy program. Results showed an increase of 14% over the four year education period. The same assessment was taken several times throughout the program but a testing effect was ruled out due to multiple forms of the assessment. Miller's study is similar to this study because CT was assessed between students in progressive years of a pharmacy program, at different levels of education, using the same assessment for each group. Both of these examples add evidence to further education increasing CT scores.

In a previous study, Zygmunt and Schafer state that analysis and inference are keys to CT.²⁶ Walker²⁸ stated that CT is using a specific idea and rule to develop a thought and then to analyze those ideas, also known as making an inference.¹ Also, the American Psychology Association defined the ideal critical thinker as well-informed, open minded, and thorough in evaluation.²² Every aspect from these studies^{1, 22, 26, 28} is appropriately listed, evaluated, and identified in the HSRT results. Health Science Reasoning Test results from this study for induction and evaluation showed a significant difference, while deduction, analysis, and inference resulted in no significant difference. One possible explanation for these conflicting results within the test is a low sample size. Another possible explanation is that each category in

this assessment does not hold the same amount of weight according to the design of the assessment by Insight Assessment.

In this study, post-professionals scored higher in the two domains of inference and evaluation as well as a higher average overall score. Inference is a skill that enables health professionals, or any other professional, to draw conclusions from evidence and reasons. Inference can be used to form a hypothesis or to make an educated suggestion. While inference can lead to conclusions, hypotheses, and recommendations, each needs to be based on correct information. If conclusions, hypotheses, or recommendations are based on faulty analyses, misinformation, bad data or biased evaluation, inference will lead to mistakes, even if the decision has been made using excellent inference skills.¹¹

Evaluation is a skill that enables the assessment of sources and the credibility of claims made from that information. In other words, evaluation is a skill that helps determine the strength or weakness of an argument or statement.¹¹ By utilizing evaluation skills athletic trainers can judge the quality of interpretations, an explanation, inferences being made, treatment options, medical opinion, ideas, and previous or current decisions.¹¹

An example of using both inference and evaluation in AT is assessing a patient without seeing the mechanism of injury and gathering the needed information from the patient. All information may not be directly available, the patient may be able to answer all questions, and an athletic trainer cannot see beyond the skin while conducting a medical assessment. Using inference and evaluation skills to find information, a plan can be developed to piece together a possible answer, or a diagnosis, for the patient.

In my experience as an athletic trainer, I have been granted the opportunity to practice my athletic training skills while advancing my education. Throughout my experience in secondary

schools and clinics, I have found that ATs use inference and evaluation on a daily basis. For example, using inference is differentiating between fact and exaggeration, or fiction, in the story of how a high school student hurt themselves outside of athletic activity while you were not present. The evidence from the accident is presenting itself to the AT through the patient but the credibility of the source must be taken into consideration.

I have also used evaluation skills many times throughout my experiences and in more situations than just a medical evaluation. Evaluation skills can be used to assess how a rotating schedule works, or effectiveness of a prophylactic taping procedure has performed, or how a patient is responding to rehabilitation exercises and if they will meet goals set for them. Both evaluation and inference are used in the profession of athletic training on a daily basis. Previous research^{9, 25, 26, 35} states that practicing CT skills can lead to increased scores on CT assessments. This explanation could be why post-professional students scored higher on the HSRT in the areas of inference and evaluation.

Unfortunately, the sample size for this study was small. When the power analysis was run, it was designed to find the smallest significant difference, which was a one point difference on the HSRT. The results of the power analysis showed that 15 participants from each program would be needed to achieve power at a .80 confidence interval. The data revealed a three point difference between the professional and post-professional groups in favor of the post-professionals. Having a significant difference that is larger than accounted for in the power analysis reduces the required number of participants needed to achieve power. The two tailed T-test results show a significant difference in the overall score and in two other categories adding further evidence to achieving the required power.

This study could be improved by modifying four factors. First, a baseline was achieved but further data collection is necessary. Second, a testing window that does not interfere with a participant's education such as end of semester testing may have provided a higher participation rate. Third, an incentive for participants beyond receiving their assessment score when finished could have to increase participation rate as well. Last, greater communication with program directors such as emailing a frequently asked questions document could increase their understanding of research goals and the benefit their program could receive from the information.

Further Research

Further research needs to be conducted in the area of CT by increasing the sample size. Additional data could be collected and then compiled to form a more accurate baseline. With more data, HSRT norms for athletic training could be formed. To increase participation, one could gather data at different times during the academic year, as the timing of data collection in this research was not ideal. When communicating with program directors, it was a common concern that testing windows occurred during the same times as end of semester finals, common times research defenses, and the first BOC testing window. These could all contribute to potential participants not having time to take the assessment. A longitudinal study could also be implemented by testing the same students as they progress through their respective programs.

Conclusion

Overall critical thinking, inference, and evaluation scores were shown to be higher in post-professional participants. Education cannot be stated as the sole contributor due to various confounding variables that athletic training education provides (i.e., clinical experience courses). However, post-professional participants had more education and clinical experience than the

professional participants, plus more time participating and conducting research. A baseline set of data was established during this study but additional HSRT results would be necessary for this baseline to be reliable and valid.

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APPENDIX A. IRB APPROVAL PAGE



Monday, July 22, 2013

FederalWide Assurance FWA00002439

Dr. Pamela Hansen
Health, Nutrition & Exercise Sciences
BBFH 9C

Re: IRB Certification of Exempt Human Subjects Research:
Protocol #HE14006, "Assessing Critical Thinking Skills of Professional and Post-Professional
Athletic Training Students"

Co-investigator(s) and research team: Daniel Adamietz, Nicole German

Certification Date: 7/22/2013

Expiration Date: 7/21/2016

Study site(s): 6/1/2016

Funding: N/A

The above referenced human subjects research project has been certified as exempt (category # 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*). This determination is based on revised consent form (received 7/19/2013).

Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- Conduct the study as described in the approved protocol. If you wish to make changes, obtain approval from the IRB prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.
- Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

Sincerely,

A handwritten signature in cursive script, reading "Kristy Shirley", is positioned above the typed name.

Kristy Shirley, CIP, Research Compliance Administrator

INSTITUTIONAL REVIEW BOARD

NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb

Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo, ND 58102

NDSU is an EO/AA university.

APPENDIX B. AMENDMENT APPROVAL

7. Does the proposed change involve a new research site?

☒ no
☐ yes



If information in your previously approved protocol has changed, or additional information is being added, incorporate the changes into relevant section(s) of the protocol. Highlight (e.g. print and highlight the hard copy, or indicate changes using all caps, asterisks, etc) the changed section(s) and attach a copy of the revised protocol to this form. (If the changes are limited to addition/change in research team members, a revised protocol form is not needed.)

Impact for Participants (future, current, or prior):

1. Will the change(s) alter information on previously approved versions of the recruitment materials, informed consent, or other documents, or require new documents?
☐ No
☒ Yes - ☒ attach revised/new document(s)
2. Could the change(s) affect the willingness of *currently* enrolled participants to continue in the research?
☒ No
☐ Yes - describe procedures that will be used to inform current participants, and re-consent, if necessary:
3. Will the change(s) have any impact to *previously* enrolled participants?
☒ No
☐ Yes - describe impact, and any procedures that will be taken to protect the rights and welfare of participants:

-----FOR IRB OFFICE USE ONLY-----

Request is: <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Not Approved	
Review: <input checked="" type="checkbox"/> Exempt, category #: <u>2</u> <input type="checkbox"/> Expedited method, category # <u> </u> <input type="checkbox"/> Convened meeting, date: <u> </u>	
<input type="checkbox"/> Expedited review of minor change	
IRB Signature: <u>Kirsty Shirley</u>	Date: <u>1/17/14</u>
Comments:	

APPENDIX C. PROGRAM DIRECTOR LETTER

October 18, 2013

Dear Program Director,

My name is Daniel Adamietz and I am a graduate student at North Dakota State University. My research project involves assessing critical thinking of students in professional and post-professional programs. The goal of this research project is to develop a baseline set of data for future research in athletic training and to form a comparison between professional and post-professional students. Students in their final year of their academic program from select universities with professional and post-professional programs will be invited.

An online version of the Health Science Reasoning Test through Insight Assessment will be used for this study. The Health Science Reasoning Test was chosen based on its ability to evaluate critical thinking skills for health science professionals. This test consists of 33 multiple choice questions and 50 minutes will be given to complete the test. The access codes and login information will be provided to each program director prior to testing.

Prior to starting this test, students will be asked basic demographic information. Test results will be available to students once they have finished and submitted the test. Information will be saved automatically and analyzed by Insight Assessment. Once data analysis is completed, your institution will be sent their results.

You will receive an email from me within the next week asking for participation. If you would like your program to participate please reply to the email.

Thank you for your consideration!

Daniel Adamietz, ATC
Graduate Student

Pamela Hansen, PhD, ATC
Associate Professor/Program Director

APPENDIX D. PROGRAM DIRECTOR INVITATION

Dear Program Director,

My name is Daniel Adamietz and I am a graduate student at North Dakota State University. My research project involves assessing critical thinking of students in professional and post-professional programs. The goal of this research project is to develop a baseline set of data for future research in athletic training and to form a comparison between professional and post-professional students. Students in their final year of their academic program from select universities with professional and post-professional programs will be invited.

An online version of the Health Science Reasoning Test through Insight Assessment will be used for this study. The Health Science Reasoning Test was chosen based on its ability to evaluate critical thinking skills for health science professionals. This test consists of 33 multiple choice questions and 50 minutes will be given to complete the test. The access codes and login information will be provided to each program director prior to testing.

Prior to starting this test, students will be asked basic demographic information. Test results will be available to students once they have finished and submitted the test. Information will be saved automatically and analyzed by Insight Assessment. Once data analysis is completed, your institution will be sent their results if requested.

Thank you for taking the time to consider participation in this research study. If you would like your program to participate please reply indicating so to the contact information listed below. Further information will be sent to programs wishing to participate in this research. Please send responses to myself, or Dr. Pamela Hansen at North Dakota State University in regards to participation. I can be contacted at daniel.adamietz@my.ndsu.edu and Dr. Hansen at Pamela.hansen@ndsu.edu.

Daniel Adamietz, ATC
Graduate Student
North Dakota State University

Pamela J. Hansen, EdD, ATC, LAT
Associate Professor/ Athletic Training Program Director
Health, Nutrition, and Exercise Sciences
North Dakota State University

PO Box 6050 Dept 2620
Fargo ND 58108-6050
phone: 701.231.8093
fax: 701-231-8872
pamela.j.hansen@ndsu.edu

APPENDIX E. PROGRAM DIRECTOR EMAIL, 24 HOUR REMINDER, ONE WEEK REMINDER

Good Morning Dr. ####,

Attached are the testing instructions for my research study we spoke about. Please forward these instructions to your senior students so they may participate in this study if they so choose. The testing window will run for two weeks, starting today (11/25), until 12/9 at 9am. If there are any questions you have, or the students, please do not hesitate to contact myself or my advisor. Both of our contact information is listed in the instructions. Thank you for your time and participation!

Daniel Adamietz ATC, LAT, ATR
Graduate Student
North Dakota State University

APPENDIX F. PROGRAM DIRECTOR PHONE CALL

Phone Call to Program Directors:

If Program Director answers phone:

Hi...my name is Daniel Adamietz and I am a graduate student at North Dakota State University working on a thesis project involving assessment of critical thinking in professional and post-professional students. Do you have a couple of minutes for me to explain my study?

YES

The goal of my research project is to develop a baseline set of data for future research in athletic training and to form a comparison between professional and post-professional students. Students in their final year of their academic program from universities with professional and post-professional CAATE accredited programs will be invited to participate. An online version of the Health Science Reasoning Test through Insight Assessment will be used based on its ability to evaluate critical thinking skills for health science professionals. This test consists of 33 multiple choice questions and 50 minutes will be given to complete the test. Testing access and instructions will be provided to each program director prior to testing. Would you willing to participate in my study?

YES: Great! Thank you! Can you please verify your email? (Write their email down). I will be sending an email out to you later this week for you to forward to your students in the program.

NO: Thank you for your time! Have a nice day!

NO

Can you I call you back at a more convenient time?

YES: (set up the time) Thank you for your time.

NO: Thank you for time! Have a nice day!

If Program Director DOES NOT answerphone.... leave following message:

Hi...my name is Daniel Adamietz and I am a graduate student at North Dakota State University working on a thesis project involving assessment of critical thinking in professional and post-professional students. This is a follow up phone call to a letter you should have received a couple of weeks ago. I would like to invite the students from your program to participate in my study and explain my study to you. Please give me a call back at 218-371-0838. Thank you!

APPENDIX G. STUDENT INSTRUCTIONS

Dear Students:

My name is Daniel Adamietz and I am a graduate student at North Dakota State University. I would like to ask for your participation in my research project regarding critical thinking in athletic training students. The goal of this research project is to develop baseline data for critical thinking in athletic training education. This study will also compare critical thinking skills between professional and post-professional students.

You have been asked to participate in this study because you are in your final year of athletic training education. Participation in this study is voluntary. You can change your mind during the assessment and you may stop at any time with no penalty.

An online version of the Health Science Reasoning Test through Insight Assessment will be used for this study. The Health Science Reasoning Test was chosen based on its ability to evaluate critical thinking skills for health science professionals. This test consists of 33 multiple choice questions and 50 minutes will be given to complete the test. Login information will be provided for you to gain test access through Insight Assessment. You can complete the test from any computer that has internet access. You may access the test any time within the designated two week testing period.

Logging in to Insight Assessment will indicate consent to participate in this study. Prior to starting this test you will be asked demographic data. The demographics will not be used identify the test taker at any time. Individual results will be immediately available for viewing and/or printing, once you have finished and submitted the test. The results will be saved automatically, compiled by Insight Assessment, and further analyzed at North Dakota State University. Your institution will receive aggregate results once testing complete. Benefit of participating in this assessment is receiving your Health Science Reasoning Test score at no cost to you. There are no known risks of taking this assessment. There is no compensation for participating in this research study.

If you have any questions, complaints, or comments, please do not hesitate to contact myself (Daniel Adamietz, ATC, daniel.adamietz@my.ndsu.edu, Dr. Pamela Hansen (701-231-8093, pamela.j.hansen@ndsu.edu), or the Institutional Review Board at NDSU (1-855-800-6717, ndsu.irb@ndsu.edu). Thank you for your time.

APPENDIX H. TEST INSTRUCTIONS

Test- Taker Instructions for on-line HRST

1. Open your browser and navigate to testing home page: www.insightassessment.com
2. Click the yellow “Test-taker Login” button at the top right of the home page.
3. When the dark blue login screen appears enter the following Login and Password:

LOGIN:

PASSWORD:
4. To ensure you do not lose your responses, please review the navigational aids on the “warning” screen and then click “continue.”
5. Give the system a moment to load Java. You will see a Java Logo and progress bar on a white screen.
6. Please fill in all of the fields on the personal profile page. You MUST click on the “save profile” button before the system will allow you to select the “continue” button.
7. Select the HSRT using the pull down menu then click “continue.”
8. Accept the User Agreement Terms.
9. Read the test instructions and continue to take the exam.
10. You may need to scroll up or down to see the navigational arrows and the “done with test/survey” button.
11. You can see the time remaining in the timer displayed on the top right of your screen.

Your responses will be submitted for scoring automatically if time expires.
12. Once you have completed the test, you may log out, or view and/or print your results.